

sDiv working group meeting summary

"Linking Landscape Structure to Ecosystem Services"

Workshop Overview

The aim of this working group is to develop new insights into the role of landscape structure for the provision of ecosystem services. Ecosystem services are the benefits (and dis-benefits) that nature provides for humans and the generation of these services depends on interactions between people and the natural environment. These interactions form part of a socio-ecological system that we hypothesise is influenced by the structure of landscapes. Therefore, understanding how the structure of landscapes influences social-ecological interactions for the provision of ecosystem services is a crucial step for being more predictive about the effect of landscape change on sustainability.

The specific aims of this first workshop were to develop a new conceptual framework for understanding the relationship between landscape structure and ecosystem service provision. Then generate testable hypotheses of the responses of ecosystem services to landscape structure. The meeting took place in December 2017 and included a diverse range of participants with backgrounds in landscape ecology, ecosystem services, social science, and economics. The participants were also from a diverse range of countries, including Germany, Sweden, UK, Australia, Canada, Brazil, and Singapore, with six female and seven male participants. The overarching approach that we took was to begin the workshop with short presentations from the PIs to seed initial ideas, followed by brainstorming and identification of topics, then finally working on workshop outputs. Overall the group spent approximately 20% of their time on presentations, 50% of their time brainstorming and sharing information, and 30% of their time working on outputs.

We began the first day with brief introductions and then presentations from the PIs Jonathan Rhodes and Jean Paul Metzger to set the scene for the working group. This was followed by short 5-minute presentations from each of the participants on their interests and what they could bring to the working group. These were interesting and inspiring presentations that highlighted the diversity of ways in which the group thought about the problem and provided for fascinating discussions during the presentations. After these discussions we distilled our ideas down to nine potential

questions/approaches for the working group to tackle. This was the key output from the first day.

On day two (following one final presentation) we made the decision to prioritise exploring a social-ecological network approach for conceptualising and predicting the effect of landscape structure of ecosystem service provision. Networks allow a structured approach to characterising social-ecological systems that can then be used to infer outcomes for sustainability. However, it has not been widely used for ecosystem service assessments, particularly in relation to landscape change. To test these ideas we split into sub-groups to discuss the potential for an emerging framework using three ecosystem services: pollination, recreation, and irrigation. A key challenge that arose from this was how to make the step from landscape structure to network structure that implicitly reflects networks structure.

Day three was spent developing typologies of different classes of ecosystem services that are expected to respond differently to landscape change based on how the spatial arrangement of ecosystem service demand and supply drives interactions between the two. For each of these typologies the group worked on writing down general equations to represent the provision of ecosystem services based on a network conceptualisation. Here we made excellent progress in describing the links between network structure, ecosystem service provision and landscape structure. This work was followed by highly stimulating talks from Örjan Bodin on social networks and Martine Maron on environmental offsets. The afternoon was spent visiting the riparian forest in Leipzig – although the general consensus was that it wasn't the best time of year for this sort of outdoor activity!

To consolidate progress so far and provide impetus for implementing the network approach, on day four we first heard from Örjan Bodin and Marie-Josée Fortin on how networks can be applied in practice to both social and ecological systems. Discussion following this allowed us to formulate a way forward using landscape simulations and to apply network analysis to understand how landscape structure may drive network structure and then ecosystem service provision. The components of the simulation analysis and writing of the structure of a proposed manuscript were then advanced in sub-groups. By the end of the day we had a simple illustration of a landscape and network simulation and analysis of the resulting network.

The final day was spent working further on the simulations and manuscript outline, discussing the way forward, and allocating tasks and timelines post-workshop. We also spent some time thinking about workshop two in July where we propose to test the predictions of the simulations with real

data. A number of data sets were identified and tasks were allocated to bring those data sets together for the second workshop as the next step for this working group.

Outputs

This workshop made contributions to generated two key outputs: (1) a framework for using social-ecological networks for understanding the relationships between landscape structure and ecosystem service provision, and (2) a manuscript on applying the framework to generate general predictions of the effect of landscape structure for ecosystem service provision.

General Summary and Feedback

Overall we believe this was a highly successful workshop where we made significant progress towards a new way of thinking for linking landscape structure to ecosystem services. The diversity of views and experience of the group allowed us to be innovative and generate new insights. Different participants contributed in different ways and we are confident that all participants will make important contributions to the final products. The support from iDiv was fantastic and facilities provided were outstanding. This enabled us to concentrate on the workshop topic alone and was a key factor leading to its success.